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WORK PLAN

SUBPROJECTS OF THE VEGETATION SURVEY

1978

GREAT SMOKY MOUNTAIN NATIONAL PARK

U. S. Department of the Interior
National Park Service
Uplands Field Research Lab

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Uplands Field Research Laboratory
Great Smoky Mountains National Park
Twin Creeks Area
Gatlinburg, TN 37738

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The Botanical Program

The program in plant ecology consists of several coordinated projects. Three major elements -- the computer programming, the vegetation mapping, and the historical survey -- are being integrated for all projects. Data collection for most plot work is on a standard format. The hog exclosure plots, for instance, can be analyzed with the same computer programs used for the fire succession study. This saves researcher time and leads to better coordinated applications to management. Although a number of individual papers and management reports will be produced, the ultimate product will be an all-park vegetation survey and maps.

The general anticipated progress of the mapping is to finish the field work for Abrams Creek and Cades Cove areas in the summer of 1978. As the three vegetation projects now under way are completed, additional blocks of the park will be added to the survey. The pattern will be to move the north-facing slope project to the LeConte area, and the Abrams Creek area to the North Carolina side, starting in Twenty Mile and moving east. The park has been divided into 16 sampling areas, some of which are larger than others. Present rates of sampling indicate that the sections will probably average 2 crews per summer season apiece for basic plot work (or 2 seasons per crew) in a section. The speed of this work may increase

as more areas are surveyed, but the whole project will take at least 4 more seasons to complete and possibly 6 seasons if detailed work is done on problem areas. The present plan is to map on 1:24,000 scale.

VEGETATION SURVEY PLOT LAYOUT

The vegetation survey will be ordered as follows:

(1) The survey will start in the western end of the park. Between 90 and 100 permanent plots will be established in Abrams Creek section (1). These will be placed to represent all elevations, exposures, and disturbance histories. Plot placement for this study will be outlined under the fire history work plan. This is to be completed by September 1978.

(2) The "virgin" section above Cades Cove (the uncut part of section 2) will be covered by approximately 90 permanent plots. These will be at 400-meter intervals on all exposures in the Ledbetter and Gregory Ridge areas. Some disturbed plots (windfall and fire) will be included in this series. The plot placement will be covered under the windfall sampling plan. This work is to be completed by September 1978.

(3) Twelve additional plots will be placed in campsites in this section. This is covered under the campsite work plan and is to be completed by September 1978.

(4) The previously disturbed area around Cades Cove is to be sampled with at least 40 permanent plots. These will be placed in all major vegetation types and in areas with different degrees of deer browse. This is to be completed by September 1978.

(5) The higher elevations in the logged Tremont section (3) are to be sampled by at least 40 permanent plots. These are to be completed by July 1979.

(6) The lower elevations at Tremont (3,400 feet and below are to be sampled by at least 20 permanent plots. These are to be completed by July 1979.

(7) After these three sections are completed, the data will be ordinated and an attempt will be made to quantify the vegetation units. Presumably, the aerial photos will be ready at this point, and mapping units will be established.

(8) A further ground truth for all three areas will be undertaken, run on regular lines on a watershed basis (the amount of technician help available will determine the intensity of this truth). The maps of this area should be completed by 1980.

(9) LeConte area (6) and Cosby area (7) will be sampled with 80 to 100 permanent plots above the cutting boundary. This should be completed by September 1980.

(10) The remaining disturbed areas in Tennessee (sections 4, 5, and 8) will be sampled with 30 to 60 permanent plots each. This should be completed by September 1980.

(11) Sampling on the North Carolina side of the park will begin as soon as Abrams Creek section is completed. It will probably begin in Deep Creek (section 12) and emphasize fire management. The North Carolina side will be sampled with 60 to 80 permanent plots a section, with the exception of Twenty Mile (9), where fewer plots are needed because of its size. This sampling should be complete by September 1982. Mapping should be complete by the following year.

(12) Additional plots will be added throughout the survey as part of campsite and grazing studies. In 1978, this will be 13 hog disturbance plots and an additional 18 to 20 campsite disturbance plots along the Appalachian Trail. In coming years, additional studies may be added at the request of park management. If fire management policy is changed, monitoring plots may be established in burned areas.

WORK PLAN

THE ECOLOGICAL EFFECTS OF FIRE ON THE FLORA AND VEGETATION OF THE WESTERN PORTION OF THE GREAT SMOKY MOUNTAINS NATIONAL PARK

PROPOSED RESEARCH FOR THE

PARTIAL FULFILLMENT OF MASTER OF SCIENCE IN ECOLOGY

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I. Introduction

After almost a half century of fire exclusion, many observers have begun to recognize the major role fire disturbance plays in natural terrestrial ecosystems (Kozlowski and Ahlgren, 1974). Evidence suggests fire was probably an important factor even in ancient forests (Komarek 1972). Numerous examples of fire adaptation (e. g., serotinous cones) indicate fire was both an evolutionary and ecological force in past environments.

Restoration of "natural" fire regimes is considered by many authors to be fundamental in maintaining the primeval characters of certain landscapes (Heinselman 1973, Houston 1973, Weaver 1974, and Vogl 1970). However, the present situation is ironic since fire exclusion has altered original forest structures. Although fire may have traditionally maintained certain vegetation types, it is now capable of destroying these communities (Kilgore and Briggs 1972). Clearly the fire-exclusion era reflects a misunderstanding of basic ecological principles. Although fire was once viewed as a totally destructive force, the recent tendency has been to overrate fire as a highly beneficial factor. In an area of high environmental diversity such as the Great Smoky Mountains, a vegetation pattern results from

the interaction of numerous factors, of which fire is only one. To truly evaluate the role of fire disturbance, vegetation patterns must be examined in light of a complex of environmental factors that are independent of vegetation.

II. Status of Fire Ecology in the Southern Appalachians

In general, the southern Appalachians represent a geographical gap in our knowledge of fire ecology. Komarek (1974) reviewed fire's effects in the southeastern United States. Over 50 citations were presented for Coastal Plain ecosystems by Komarek; two of these references were bibliographies which cited over 1300 titles! In direct contrast only 4 references were cited for the southern Appalachian region, and these dealt with fire history or occurrence only.

The influences natural fire have had upon vegetation pattern and structure are far from being understood in the southern Appalachians. Fire has been considered a force which might create or maintain grassy bald (Wilhelm 1972), heath bald (Whittaker 1956, Cain 1930) xeric oak (Whittaker 1956) and pine communities (Barden and Woods 1976, Wilhelm 1972, Zobel 1969, Whittaker 1956 and Cain 1937). Although fires have probably occurred in all these communities, the following discussion will be restricted to types in which fire is most likely to play a part: pine and oak dominated forests.

Cain's (1937) observations in the Mt. LeConte - Greenbrier area led him to believe recurrent fire maintained subclimax pines on many sites. Cain also mentions, however, that on the rockiest, driest sites, pine may constitute an edaphic climax.

While conducting an extensive forest inventory in the Great Smoky Mountains, Miller (1938) observed profound differences in fire behavior which correlated strongly with canopy type. In particular, he noted the yellow pine-hardwood types as the communities where fire behavior was most likely to be extreme. These remarks are surprisingly similar to the Mutch hypothesis (1970).

Whittaker (1956) stated recurrent fire maintains both mixed pine forests and chestnut oak-heath forests on xeric sites. Although mesic species invade both types of forests, Whittaker indicates the completion of invasion and replacement phases exceeds the time between fires in the southern Appalachians. Unfortunately, no fire history or invasion rates are presented, so the theory is somewhat circular. In Whittaker's scheme, less resistant species are girdled and eliminated by fire, while suitable seedbed conditions are created for pine reproduction. Whittaker also uses this scheme of

disturbance to explain the creation of new pine dominated forests.

On almost all of the stands observed by Zobel (1969), age structure, fire scars, and charcoal indicated fire was an important environmental factor in the table mountain pine's life history. Pine regeneration was highest on intensively burned stands where both canopy and understory were completely removed. In some populations, cone serotiny was also found to be a common trait which would imply some degree of fire adaptation in table mountain pine.

In examining the vegetation of the Mt. LeConte area, Golden (1974) found evidence of burning in table mountain - pitch pine forests. In direct contrast, many pure table mountain pine stands lacked evidence of past fires; hence, fire's role in certain pine communities may have been overrated.

Barden and Woods (1976) examined post-fire succession in low-elevation pine and hardwood forests. They found that the extent of pine reproduction relates directly to the amount of canopy top-killed. Even though cool, creeping ground fires removed litter and exposed

mineral soil, pine reproduction was not favored on these sites. Hardwood dominance was found to increase after cool ground fires since the fire only top-killed broadleaf species, and vigorous sprouting occurred. Hot ground fires and crown fires, on the other hand, removed most of the overlying canopy, and hence increased light intensity at ground level. This, in turn, led to an abundance of pine reproduction.

After analyzing 14 years of southern Appalachian fire records, Barden and Woods (1974) concluded lightning fires rarely damage canopies severely enough to initiate wide-spread pine reproduction. In comparison, man-caused fires were found to exhibit more severe behavior. Barden and Woods (1976) hypothesize that without man-caused fires or lightning fires burning during periods of extreme drought, the present-day, extensive pine communities will retreat to refugia on xeric, exposed, south-facing ridge-tops. Barden (1977) has perhaps found an example of the hypothesized refuge community at Looking Glass Rock, North Carolina. At this location, table mountain pine was observed to reproduce without fire disturbance.

The majority of fire ecology literature pertaining to the southern Appalachians centers around the yellow

pine communities. This circumstance is unfortunate since many other communities are probably influenced by fire. For instance, in New York State, oak and northern hardwood forests respond quite differently to fire disturbance (Swan 1970). Even though many communities are not created or maintained by fires, it is likely that the burning disturbance is an important influence. Another obvious omission in the literature is a consideration of fire effects on understory vegetation. One might expect to find fire-created, fire-maintained, or fire-influenced understories analogous to the canopy strata.

As important as the actual disturbance of a stand would seem, no one has directly quantified this parameter. In only one study (Zobel 1969) was tree reproduction observed immediately after a fire, although Barden and Woods (1976) observed stands 10 - 20 years after known fires. The degree fire interacts with other site conditions, and their relative importance in determining vegetation pattern is not clear. A major problem in deciphering this interaction is the fact that fires have never been quantified other than to say they were present. It would appear that years since burn, intensity and frequency would all be important factors in assessing the present vegetation pattern and fire's influence upon it.

III. Study Objectives

The short term and long term effects of fire disturbance will be evaluated in the study area. A number of hypotheses will be tested which deal with three phases of fire disturbance: 1) immediate disturbance, 2) short term recovery and colonization (1 - 2 years), and 3) long term recovery and colonization (10 - 50 years).

A. Immediate Disturbance: Hypothesis 1

Assuming a constant burn severity, the degree a fire disturbs a forest depends upon stand structure and composition. This implies certain species have a higher probability of maintaining their original positions (e.g., canopy vs. shrub) but that this probability changes as individuals enter larger size classes. Since both composition and structure change as a stand develops, there should be points on the successional gradient where the effect of fire disturbance is greatest, all other factors being equal.

B. Immediate Disturbance: Hypothesis 2

If a series of stands with identical structure and composition were burned, one would expect only the most resistant individuals to survive as fire severity increases.

C. Short-Term Succession: Hypothesis 3

The degree a fire disturbs a stand influences the post-fire successional pattern. Both the amount of canopy removed and litter consumed influence the recovery of top-killed vegetation and the amount of colonization by seed reproduction. Recovery and reproduction are expected to be highest in stands where canopy and litter removal are greatest.

D. Short- and Long-Term Succession: Hypothesis 4

Vascular plant diversity is highest in stands 1 to 3 years after a fire. The larger the disturbance, the greater the increase in species diversity. Secondary peaks in diversity occur as succession progresses toward the "climax" stages.

E. Short- and Long-Term Succession: Hypothesis 5

Topographic moisture, and fire disturbance gradients interact on both a short and long-term basis. As time increases the effect fire had on a stand decreases until topographic-moisture relations become dominant. If disturbance intensities were similar, one would expect different species to colonize two sites if topographic-moisture positions differed between them. Viewed from a long-term perspective, one would expect both

the seral and "climax" stages to differ significantly along the topographic-moisture gradient.

IV. Methods

A. Study Area.

The study area encompasses the westernmost portion of the Great Smoky Mountains National Park. Physiographically, the area consists of numerous low-elevation ridges drained by Abrams and Panther Creeks. According to Heritage (1939) a large portion of these forests were never cleared, although fire, insect attack, chestnut blight, windthrow, and selective cutting are or were common disturbances. This is probably the driest area in the park and has had a relatively high incidence of both lightning and man-caused fires.

B. Field Technique

Vegetation sampling will be divided between observations of recent, old, and unburned stands. When the opportunity provides, fires of differing severity will also be sampled. Between 90 and 110 samples will be distributed systematically on gradients, and replicates will be taken if time permits. Recently burned plots will be revisited annually until the analysis phase begins.

Within-plot sampling follows guidelines established by Bratton (1978) for the current parkwide vegetation survey. Briefly, the plots are permanently marked, 50-

meter by 20-meter rectangles in which tree (one centimeter DBH and above), shrub and herb strata are sampled. Trees are measured throughout the whole plot while shrubs and herbs are observed in 25 random subsamples. Vascular plants not occurring in these subsamples but within the larger plot are recorded as present. Four modifications will be made on this scheme:

1) tree tallies will include top-killed individuals to reconstruct prefire conditions
2) fire damaged trees will be categorized into classes based on epicormic sprouting, basal sprouting, no sprouting, etc.
3) a random sample of basal sprouts may be examined for vigor
4) the number of shrub plots may be increased on recently burned stands to give better estimates on tree reproduction.

Site parameters such as slope, topographic position, site conformation (i.e. convex versus concave), aspect, elevation, years since burn, and the presence of other disturbances will be recorded for each plot. Historical records will be the preferred method of dating past disturbance, but when this is lacking, field evidence will be used. Fire scars and presence of charcoal will be used to either date or provide evidence of past fires.

C. Analysis of Data

The analysis phase will be partitioned into three segments: 1) immediate disturbance, 2) early recovery and colonization, and 3) long-term successional and topographic moisture patterns.

Differences in canopy structure before and after fire treatment will be tested using non-parametric statistics. Comparisons will be made between treatments (e. g., hot versus cool fires) and within treatments on a species size-class basis. The vigor and type of sprouting of top-killed plants will also be examined using non-parametric statistics on a scheme similar to above.

The relationships between 4 independent variables (residual litter, overstory structure, topographic-moisture, aspect) and one dependent variable, seed reproduction, will be developed using regression methods. If this approach fails correlation methods such as factor analysis will be used.

Data from recent, old and unburned stands will be pooled for ordination analysis. Bray-Curtis or Principle Components Analysis will be used to discriminate vegetation patterns. If gradient distortion is not a major problem, direct gradient analysis will be

attempted. Diversity indices will be superposed on direct and/or indirect ordination patterns.

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WORK PLAN

THE ECOLOGY OF NATURAL DISTURBANCES IN LOGGED AND UNLOGGED STANDS IN THE CADES COVE AND TREMONT AREA OF GREAT SMOKY MOUNTAINS NATIONAL PARK

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WIND, TREEFALL, AND LANDSCAPE IN GREAT SMOKY MOUNTAINS NATIONAL PARK

INTRODUCTION

Understanding natural disturbance is fundamental to the understanding of vegetation - landscape relations. The two most important reasons for this statement are: (1) Natural disturbances initiate compositional changes, either by the creation of open sites or by altering the environmental setting of the individuals that persist through the disturbance. The effect on the environment is indirect, occurring through the destruction or alteration of community structure. (2) Natural disturbances are also correlated with landscape positions -- different kinds of disturbances operate in different parts of a landscape <u>and</u> a given kind of disturbance may have different frequency, predictability, and magnitude over its areas of occurence in the landscape. Natural disturbance may also be correlated with the nature of the vegetation; e.g., the 'fire-promoting' habit of pines.

Landscapes can be characterized by their disturbance regimes, as they are by their environmental and vegetational gradients. A large percentage of regional floras and faunas are probably, to some degree, dependent on situations created by the recurrent play of natural destructive forces. The dynamics of vegetation must be taken into account in the building of models of vegetation - landscape

3. FISHEYE MIRROR PT. SAMPLING. 25 points to receive designations as to L (full light, open sky) or S (shade). There will be 5 to 10 sets of these depending on how many of the 10 x 10 meter subplots are sampled for reproduction.

ANALYSIS:

Data gathered from this project will be analyzed for the following, using regression and ordination:

1. The internal successional sequence in an undisturbed community -- probable product, one journal article.

2. The differences in stand dynamics between logged and unlogged stands in similar topographic positions -- probable product, two journal articles.

3. A stand classification for logged and unlogged mesic communities -- to be used for mapping.

4. If this project is continued into a second year -- an attempt will be made to investigate more natural disturbances, including landslides, and to investigate synergistic effects between windfall and fire.

relations -- models that can be used in prediction for management decisions as well as in answering questions of ecological theory. If the "natural" successional responses and patterns are understood, it becomes possible to

(1) model the structure of mature forest communities through time;

(2) discriminate between "natural" changes and man-caused effects;

(3) evaluate the ability of a stand to tolerate man-caused disturbances; and

(4) monitor changes, both "natural" and man-caused.

Preliminary reconnaissance of Great Smoky Mountains National Park suggests the following list of important disturbance processes: Fire (pine and oak ridges; balds), wind (a gradient from the fall of individual trees to larger blowdowns), debris avalanches (steep upper slopes), streamside erosion (not important on an areal basis for the park as a whole), ice storms, and insect outbreaks (beetle kill in pines). Alluvial floodplains, a much disturbed habitat, are important only in the lowest elevations of the park. Of these processes, wind-created dynamics (defined to include gap phase reproduction) are probably the most widespread kind of disturbance in Southern Appalachian forests. The sampling scheme presented below will help us better understand those dynamics and how they are related to topography. Fire, the predominant disturbance of

xeric ridges, is the subject of a current study by Mark Harmon. In pine forests there may be an interaction between fire, windfall, and beetle infestations.

Dynamics created by wind range from the death and blowdown of single senescent trees (initiation of canopy gaps) to the windthrow of large patches of forest. The diverse topography and vegetation of Great Smoky Mountains National Park means that there is a great range in wind effects. The present work plan for the 1978 field season focuses on the reproductive patterns of tree species along the disturbance gradient from single tree falls and small canopy gaps to larger disturbances. A second tact will be to use aerial photographs and historical records to assess windstorm frequency in the park and its relation to topography. The present field sampling requires four additions to the general permanent plot vegetation survey currently underway and described elsewhere.

VEGETATION TO BE SAMPLED - 1978

Two field crews will work in the virgin watersheds south of Cades Cove, starting at Parsons Branch/Gregory Ridge Trail area and working westward to and hopefully beyond Mill Creek valley. The cutting boundary is at about 2,300 feet and the ridge line is at about 4,200 - 4,800 feet.

A third field crew will work in the logged-over watersheds above Tremont. These plots will be matched topographically against the virgin watershed plots. Comparing data from the logged and unlogged watersheds will allow us to determine the difference in disturbance processes in the two areas and judge longterm effects of logging on the composition and structure of the communities. In effect, we are seeing the natural disturbance overlay to results of human disturbance. To a certain extent there has also been human-caused disturbance in unlogged watersheds as well: introduction of chestnut blight, hog rooting, firewood gathering, trailside erosion, and disturbances caused by population fluctuation of native animals due to removal of natural predators, such as the mountain lion.

The three field crews will contribute a total of about 120 .1 hectare plots this summer. Last summer's experience suggests that 20 plots are needed to sample one main ridge; thus six ridges could be sampled this summer. However, adding the disturbance-oriented sampling will reduce this total somewhat.

The distribution of samples by elevation and topography is shown in the table on the next page.

1. PLACEMENT OF 50 x 20 METER PLOTS. Entire 50 x 20 plots may be used in the few large windthrows presently known in the area to be studied. Smaller canopy disturbances down to single tree gaps will be sampled by positioning the 50 x 20 meter plot so that the most

disturbed area is located in the left-most subplot (facing uphill). In the event that the whole plot is evenly disturbed or evenly undisturbed (there is not perceptible gradient in canopy disturbance), this will, of course, be impossible. See illustrations.

Each of the 10 x 10 meter subplots will receive a canopy disturbance scalar to be recorded as follows:

10 = Closed canopy (probably no canopy is completely closed; this designation will be used for the average canopy condition encountered in stands without recent disturbance).

20 = Small canopy opening due to the recent fall of a good sized tree limb or a medium sized tree.

30 = Average sized treefall gap; open sky over much or all of the 10 x 10 meter subplot. 1 - 5 canopy trees down.

40 = Larger gap; 5 - 25 trees down.

50 = Major windstorm; the area is part of a large blowdown. 25+ trees down.

EDGES OF THESE TYPES WILL BE INDICATED BY ADDING 5 TO THE ABOVE NUMBERS:

25 = Edge of a small canopy opening

35 = Edge of an average tree gap

45 = Edge of a larger gap

55 = Edge of a major windstorm

(There is no category 15.)

See illustration.

2. PLACEMENT OF 2 x 2 METER PLOTS. The 10 scalar values assigned in a 50 x 20 meter plot will determine which of the 10 x 10 meter subplots will be sampled with diagonals of 2 x 2 meter reproduction plots (these are to be sampled without modification as in the general vegetation survey program). The distribution of 5 or more diagonals must reflect the frequency of canopy disturbance conditions as indicated by the scalar. This will impose a certain rigidity on the reproductive plot sampling; however, whether the diagonal runs from upper left to lower right or from lower left to upper right will be randomly determined.

In most plots the scalar value will be 10 (closed canopy). Hence, the sampler must primarily keep track of the occurrence of other scalar values so that these also will be sampled for reproduction. This should result in a series of five 2 x 2 meter plots for each of the canopy conditions in a given 50 x 20 meter plot.

3. STANDING DEAD TREES AND RECENT WINDFALLS. The species and dbh of standing dead trees will be recorded as has been done in the past. To this will be added the recording of species and dbh (or as close as possible to this) of fallen trees rooted (or formerly rooted) in the plot. Only trees with bark still on will be sampled. A meter stick will probably be easier to use than a dbh tape, as it may be impossible to get the tape around the fallen trunks.

4. MEASUREMENT OF CANOPY CONDITION. Two methods will be field tested, both involving 'fish eye' views of the canopy. One will involve taking black and white photographs of the canopy with a 28 mm lens. The other will involve using a convex mirror with a grid system superimposed on the mirror surface. The photographic method yields a permanent record of canopy conditions; a grid system can be superimposed on the photograph for quantifying the amount of openness and shade. On the other hand, the mirror method is cheaper and faster and not subject to as many possible points of mechanical breakdown.

In either case, the methods will be employed at the center of the 10 x 10 meter plots which are being sampled for reproductive layers. The camera and mirror will both be held horizontally and aimed vertically at the canopy. The mirror may require two reading since the position of the observer will result in a somewhat distorted view.

DATA PAPER REQUIRED:

1. SCALAR VALUES: 10 two-digit numbers are to be recorded for each of the 10 x 10 meter subplots.

2. STANDING DEAD AND WINDFALL. Species and dbh to be recorded; appended to existing system for recording standing dead?

Distribution of Sample Plots by elevation, topography, and canopy condition scalar

ELEVATION	TOPOGRAPHY-VEGETATION	CANOPY CONDITION SCALAR (Subplots with this value)					
		UNLOGGED			LOGGED		
		10,20	30,40	50	10,20	30,40	50
2,400 feet	Cove-hardwoods	xx	2	?	xx	1	?
	Cove-hemlock	xx	2		xx	1	
	Cove-mixed oak	xx	2		xx	1	
	Slope-mesic oak	xx	2		xx	1	
	Slope-xeric oak	xx	2		xx	1	
	Ridge-pine and oak	xx	2		xx	1	
2,800 feet							
3,200 feet							
3,600 feet							
4,000 feet							
4,400 feet	Heath and grassy	xx			xx		
4,800 feet	balds	xx			xx		

Large windstorm areas (scalar = 50) are expected to be rare and will be sampled when located.

Closed canopy stands and stands with small disturbance (10,20) will make up the bulk of the sample.

Stands with small to large gaps will be sampled (30,40) so that each vegetation type - topographic position will be replicated in the data from unlogged watersheds and matched by data from logged watersheds.

WORK PLAN

ANIMAL GRAZING

ANIMAL IMPACT STUDIES

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CADES COVE DEER BROWSE STUDY

AND

OLD HOMESITE SUCCESSION

The purpose of this study is to assess the impact of white-tailed deer on the vegetation in and around Cades Cove. The data will also be used to construct a classification of successional plant communities on land that was previously farmed.

The basic questions to be answered are:

(1) How is the large herd of deer impacting the flora of the cove?

(2) Are any native species being eliminated?

(3) How does the impact of deer in Cades Cove compare to that in other successional areas?

(4) What are the probable long term effects of deer browse in Cades Cove?

Methods:

The plot sampling methods outlined in "Vegetation Survey, Great Smoky Mountains National Park, 1978" will be followed. All sample plots will include a tree map and stem count for the understory.

Plot placement will be in a variety of locations around the edge of the cove, including:

(1) special protection areas

(a) Gum Swamp

(b) Houston-Chambers Pond

(c) Gregory Cave

(d) Oliver wet meadow

(2) Previously (cattle) grazed wood lots.

(3) Wood lots with no recent history of grazing.

(4) Fields, old fields, and stock grazed areas.

(5) Successional forest which is away from the edge zone.

(6) Successional forest, probably in Abrams Creek area.

The total sample will be 40 to 50 plots. Sample will be analyzed for understory composition, including the number and size of reproductive woody stems. An attempt will be made to model the canopies and predict potential changes due to deer browse.

Aside from the plot sampling, an attempt will be made to construct a limestone floristic list for the Cades Cove, White Oak Sink, and Bull Cave areas.

Old locations for rare species in Cades Cove will be rechecked and an attempt will be made to locate sensitive areas. These will be discussed in a special limestone area report.

The final analysis will include community composition, diversity, and reproductive condition for sites immediately in and around the cove and sites farther from the agricultural area. Standard programs will be used, including the Uplands series for plot summaries, CEP ordination programs, and SAS statistical programs.

HOG EXCLOSURE STUDY

The purpose of this study is to determine the rate of recovery of a rich herbaceous understory after hog rooting and to monitor long term changes in extensively hog-rooted plots.

The questions to be answered are:

(1) How quickly can an intensively rooted plot recover after hogs have been excluded?

(2) What changes are occurring in areas repeatedly rooted by hogs?

(3) Which species are the most sensitive to rooting and which recover the most quickly after rooting ceases?

(4) How is the canopy affected over a period of time?

Methods:

Seven 8 x 8 meter exclosures and five 20 x 50 meter matching plots have been established in intensively rooted grey beech forest. Four of the exclosures and two of the matching plots are near Double Spring and the remainder are near Spence Field. Plot sampling follows "Vegetation Survey, Great Smoky Mountains National Park, Summer 1978". All plots were tree mapped and sampled for

woody understory in July 1977. Herbaceous samples (16 square meters in the exclosures; 25 square meters in the matching plots) are being repeated annually in both May and July. The sampling will continue for at least five years. The canopy will be resampled at the end of the study.

Analysis will be by standard Uplands plot summary programs and SAS statistical program (largely regressions).

WORK PLAN

THE EFFECT OF ESTABLISHED CAMPSITES ON THE NATIVE VEGETATION OF GREAT SMOKY MOUNTAINS NATIONAL PARK

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INTRODUCTION

The purpose of this study is to investigate the effect of established campsites on the native vegetation of Great Smoky Mountains National Park (GRSM). The study will be coordinated with the general vegetation survey for the park and will use the same basic sampling scheme. This project will look in detail at trampling and removal of native forest understory, soil compaction, opening of the canopy, restriction of tree growth, and invasion by exotics.

METHODS

All plant data will be recorded using the master species check list for the park. Plant sampling will follow the instructions for the general vegetation survey. The sampling procedure will be established for each site: one in the center of the disturbed area, one at the periphery of the tenting area, and one outside of the tenting area, but within the human impact zone. At least one further plot will be established outside of the human impact area. All of these plots will be 20 meter by 50 meter transects (in 5 subplots) with plot 1 falling in the most intensively disturbed site (see drawing).

Aside from completing all the standard information on the vegetation survey forms, a series of penetrometer readings will be taken by

subplot and a series of black and white photos of the canopy will be taken to assess open. If time permits, investigators will obtain 10 tree cores from heavily trampled areas and 10 tree cores from a similar undisturbed site.

Sample sites: Sites in the present vegetation survey study area will be used, and at least six will be sampled. These should include:

Sheep Pen Gap (high elevation hardwood)

Anthony Creek (native cove)

Eakaneetlee (mature cove)

Rough Creek (successional cove)

and at least two more to be selected.

Data analysis: All the data will be keypunched for analysis by Uplands Vegetation Programs. The penetrometer readings and canopy opening values will be analyzed by regression to determine trends with distance from the center of the site. Data from damaged and undamaged sites will be compared.

Sampling routine:

*(1) Establish corners on plot

*(2) Do herb-shrub sample

(3) Do human impact sheet

(4) Take canopy plots

(5) Take area plots

*(6) Tape trees

(7) (Some selected plots) Core 10 trees

*(8) Run standard fuel loading survey

*Instructions available in all park survey booklets

In most cases, the investigators will be camping in the site they are sampling and travel time will not be a major item.

HUMAN IMPACT SHEET

The human impact sheet should be used for sites with recent or ongoing human impacts. Mowed roadsides, campgrounds, campsites, and lawns all belong in this format.

The first line is for the whole plot.

Sec = Section No.

Plot = Plot No.

Camp = 1 Campsite

2 Shelter

3 Illegal site

0 No camp

No. = Site number

Mowed = 1 - Yes

2 = No

YR = Most recent year mowed; i. e., 77

Road = 1 - Adjoining gravel road

2 - Adjoining asphalt road, single lane

3 - Adjoining asphalt road, double lane

4 - Adjoining parking area

Lawn = 1 - Yes

0 - No

Hay = 1 - Grazed

0 - No

Building = 1 - Near building

0 - No building

Dist Center = Distance in meters from the impact center of site

Dist road = Distance in meters from the nearest road

Dist trail = Distance in meters from the nearest trail (backcountry only)

% Canopy = The percent of the plot under a tree canopy (general 8 meters or more high). This measure is not intended to discriminate damaged canopies but to determine the percent of the plot forested. Full plot should be 100 percent; open fields 0 percent.

Ramps = 1 - Digging of ramps

2 - Digging of ginseng

3 = Harvest of flowering species

0 = No evidence

Percent = Percent of soil surface disturbed, 1-99

The next five lines are all filled out by subplot starting with 1 (which should be in the most disturbed section). The sixth digit on the section, plot blanks, is the subplot number.

Pits = Number of fire pits <u>in subplot</u> (not in campsite)

Bare = Percent of bare soil (of 200 square meters)

Litter = Percent of leaf litter present

WORK PLAN: CAMPFIRE USE

The purpose of this study is to evaluate the relative amount of campfire use in Great Smoky Mountains National Park. The sheets should be filled out each time a campsite is visited. The study will be conducted June 20 through August 20, 1978, and may be repeated at a later date, during colder weather.

More than one site may be put on a sheet. Most of the blanks on the sheet can be filled in with the questions used during a routine permit check. If checking permits after dinner or breakfast time, inquire about stove and fire use if necessary. (That is, include activities from earlier in the day at the same site, such as stove, then fire use.)

INSTRUCTIONS

Site:	Campsite number or shelter number as designated in permit code
Date:	Month, day
Time:	In hundred hours
P #:	Number in permit group, or in illegal camping group (check illegal column if latter)
Horse:	Check if campers are on horse
Illegal:	Check if party is camped illegally
Stove:	Check if party uses stove. If more than one group shares stove, record sharing use. Write 1 for first stove and 1 in stove box for all groups at campsite sharing that stove. Two groups and two stoves: write 1 for first group and 2 for second, then 2 in box for any group sharing second stove. 0 for an unsuccessful attempt.
Fire:	0 - Attempt, no fire Record fire-sharing like stove
Pit:	Check if fire is in pit or place built by the park
Cooking:	Check use of fire if applicable
Drying:	Check use of fire if applicable
Warming:	Check use of fire if applicable
Not dead and down:	Check if improper wood was used for fire building
Saw/Ax:	Check if party possesses either

WORK PLAN

HISTORICAL IMPACTS AND PLANT SUCCESSION:

A STUDY TO PARALLEL THE VEGETATION SURVEY

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The purpose of this study is to locate previous disturbances which have affected the structure of plant communities in Great Smoky Mountains National Park. The project is part of the Biosphere Reserve program.

The program is divided into three parts:

(1) Agricultural impacts

(2) Logging

(3) Fire, windfall, etc.

These will be approached separately, as is appropriate to the individual watersheds.

In each case, old maps, historical records, and the completed work of other investigators (such as Bill Hooks, Weaver McCracken, and Randolph Shields) will be reviewed first. This may be supplemented by interviews (to be taped when possible). A selection of sites will be field checked.

The first goal of the project will be to find the locations of:

I. Homesites

(a) House and yard

(b) Barns and out-buildings

(c) Cleared fields

(d) Pastures

(e) Wood lots

II. Churches and cemeteries

III. Grazing territories

(a) Cleared or partially cleared areas

(b) Forested areas

(c) Herders' cabins, gant lots

IV. Logged areas

(a) Sawmills

(b) Logging camps

(c) Cut zones (with grade of cut)

(d) Slash fires

V. Access routes

(a) Roads

(b) Railroads

(c) Skidder trails

(e) Splash dams

VI. Burns

(a) Areas burned frequently

(b) Sites of single fires

VII. Other

(a) Mines

(b) Stills

(c) Mills

The information is to be placed on master maps and may eventually be computerized.

The most important biological questions to be answered are:

(1) Where is the absolute cutting boundary?

(2) Where is the cutting boundary for high grading?

(3) Which areas had extensive man-caused fires?

(4) Which areas were burned regularly for fruit crops or other purposes?

(5) Which areas were open at the time the park was established?

(6) Which areas were commercially logged?

(7) Where were exotic species introduced?

(8) How did the state of the land at the time of abandonment influence plant succession?

(9) Which areas had natural fires?

The most important cultural questions are:

(1) Why did cutting or grazing stop where it did?

(2) Who owned "unused" tracts?

(3) How were the farms divided in terms of acreage? Why?

(4) How did cultural uses relate to topography and forest type?

(5) Were any areas cleared by the Indians? How and where?

The record for impacts should include:

I. Exact location

(a) Map

(b) UTM coordinates

(c) Section and quad

II. Date of event or abandonment.

III. Intervening disturbance

IV. Source of information

(a) Written record

(b) Interview

(c) Field inference

V. Verification

(a) Field check

(b) Tree cores, etc.

Field checks of homesites and logged-over areas should include the presence or absence of:

I. Exotics

II. Flowers

III. Rare and endangered

IV. Existing structures

Known sources of information for this study include:

(1) Maps of homesites

(2) Maps of cemetaries

(3) Property records

(4) Logging records

(5) Old air photos

(6) Old vegetation map

(7) Old soil surveys

(8) Deeds; courthouse records

(9) Fire atlas

(10) Superintendent's reports

(11) Studies by other investigators

(12) Personal journals

After past disturbances have been mapped, the areas will be vegetation-surveyed to determine the structure of the successional communities.

WORK PLAN

RARE AND ENDANGERED SPECIES

AND

VASCULAR CHECKLIST UPDATE

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RARE AND ENDANGERED PLANT SPECIES AND SPECIAL PROTECTION AREAS

The purpose of this project is to determine the status of the rarer plant species in the park. Emphasis will be placed on species on national and state lists, but species which are merely uncommon within the park will also be included. Sites with unusual combinations of species will also be sampled. The final product will be a status report on rare plants and a series of special protection areas.

Methods:

(1) The herbarium collections will be coded on to sighting forms. Computer sorts will be used to determine the number of collections, dates, and areas.

(2) Previous collection areas will be rechecked in a systematic fashion. Top priorities will be

(a) limestone sites

(b) Mount LeConte

(c) Little River Gorge

(d) grassy balds and burn scars

(e) bogs and flood plains

(f) lower Abrams Creek

Sighting sheets will be filled out for each area investigated and each rare plant sighted. (See Bratton, S. P., Rare Plant Status Report, 1978 for a list of species on national and state lists).

Descriptions will be written for each area and the sites will be placed on master maps.

(3) Individual sites will be plot-sampled according to the vegetation survey standards. The plot summaries will be included in the final reports for each area.

Areas to be sampled include:

(a) Gum Swamp

(b) Houston-Chambers pond

(c) Cliff Tops

(d) Oliver wet meadow

(e) White Oak Sink

(f) Bull Cave area

(f) Little River Gorge

The beech gaps have already been sampled, as has the Hannah Mountain area.

Maps of the sites will be included with each description.

(4) The vascular checklist for the park will be edited and updated. This update will include status of the species in the park and other information.

All details of the sampling schemes are in the data books.